

# Here Come the Defiants!

Several Defiant projects are well on their way to completion.

BY DON DOWNIE

**T**he people involved with the Defiant project are a dedicated group. Anyone tackling a 2000- to 4000-hour, 1½- to 5-year project as a hobby has to be an unusual sort of person. We asked Fred Keller of Anchorage just how the Defiant project had already changed his life.

"In many ways," he replied. "One thing which created lots of anxiety was trying to document the project to a standard which would get the job done but live up to Burt's thoroughness for producing the

best. Sharon Kay (Keller's wife) and I have met many new friends because of the Defiant. I guess the one thing which has meant the most to us is just being a part of this time in aviation and knowing someone like Burt."

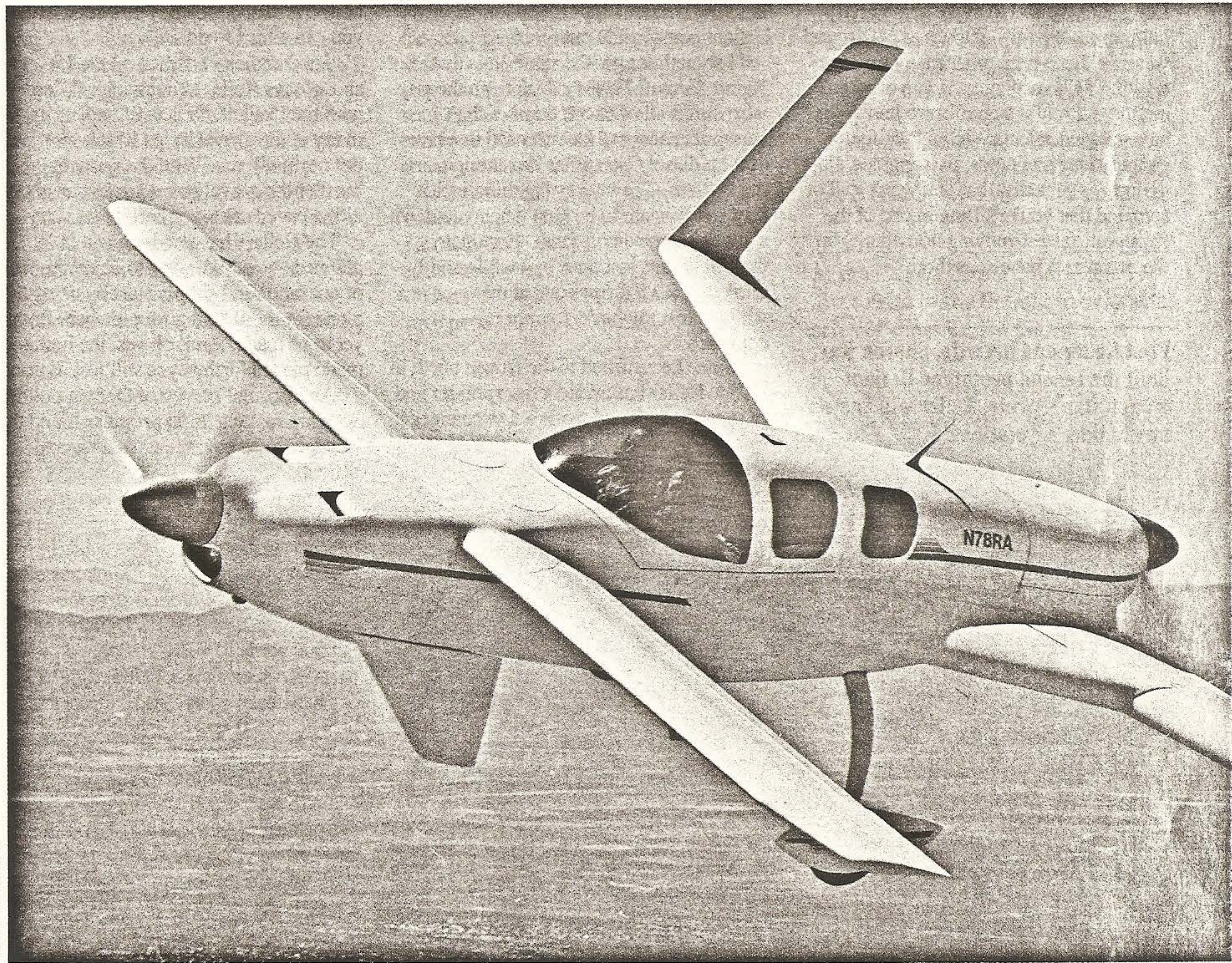
His most interesting phone call to date was from Bianco Groppelli in Milan, Italy. "Groppelli and a couple of his Italian buddies wanted to build a Defiant; actually so much so that after a couple of months of phone calls, he was on a jet to

Alaska for a visit and to see the Defiant. To say that he was enthusiastic is an understatement. We spent four days and nights doing nothing but talk Defiant. He was our house guest.

"We did get a chance to take him out for

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**Fred Keller's Defiant was the second prototype built; Its 1200-mile range and twin engines make it ideal for Keller's flights over the wilds of Alaska.**



Photos: Don Downie



## BUILDERS

continued

a look at Anchorage, Palmer, Matanuska Glacier and other sights in the Defiant. Bianco was really impressed with the room, comfort, performance and especially the twin-engine aspect because, as we were flying over the rugged glaciers, my aft-engine oil-pressure gauge decided to test our nerves by doing a special dance from zero to 80 psi. I kept close watch on all the other related gauges and saw no problems. The trouble was later traced to a faulty gauge.

"This actually brings up the most important thing that my wife and I like about the Defiant—being able to cover the vast areas of Alaska and Canada with double the assurance that we will get there without risking our lives. When we were flying back from the 'lower 48' with Mike and Sally Melvill and Bruce and Bonnie Tift (each couple in their respective Long-EZ) we had to make some pretty hairy cross-country detours to get around weather. I can remember many times wishing Mike or Bruce had an extra engine. It's really a comfort to know you have two electrical systems, two fuel gauges, four magnetos, two engines, 115-gallon gas capacity, that you won't stall or spin and that you're sitting in one of the strongest, fastest-moving homebuilts on the market. What else is there?"

**Fred Keller and his wife, Sharon Kay, built the second prototype Defiant from Rutan's plans; Keller will answer any builder's questions.**

"Actually, the Defiant is the most well-rounded aircraft a person could own and build. It has the performance of a twin, the flying safety of a single and the size of a station wagon; it looks like a starship and handles like a big pussy cat. And on top of that, it is a very easy airplane to build."

Keller has arranged to answer builder questions on Monday, Wednesday and Friday nights between 6 p.m. and 9 p.m., Anchorage time, which puts the calls on economy night rates for the contiguous United States. The only person who has complained so far, according to Keller, is Johnny Murphy of Florida; he has a hard time staying awake until it's time to call. The calls were fairly regular when the plans first came out but have tapered off to just a few a week for the past few months. Mike Melvill (in Mojave, California) is handling builder support and knows the Defiant plans inside out.

"I sometimes get the same calls that Rutan Aircraft Factory does from the guy who thinks all of us are dumber than stumps because we haven't used that new 400-hp diesel Caterpillar 'dozer engine on the Defiant. The interesting thing is that they really seem to be hurt when you don't show the same enthusiasm. Fortunately, these folks are just once in a while and I think that RAF throws one at me once in a while to test my builder support approach."

Since he returned to the frozen north in 1984, Keller has added a transponder and a stereo player and made a few changes in

some of the gauges. "The plane has flown and performed so well that there has been little to do. I do plan to remove the front engine for a complete overhaul. This was a high-time (2000 hours) O-320-E2A, 150-hp, Dynafocal-mount engine which I personally removed from the front of a flying Piper Cherokee 140. Once overhauled, Defiant No. 002 will be ready for many hours of travel and airshows planned for this summer."

When it comes to picking engines, Keller feels that the Lycoming O-320 or the O-360 would be his choice. "I recommend that the homebuilder use mid- to high-time engines which are in good running order. Most of the time you can buy them right off the plane and they have many hours left in them. This reduces your initial cash outlay and provides a safe 'proven' engine. It gives you an engine to have overhauled many years later when you can afford to do so."

"She handles very nice on the ice and snow," says Keller about winter flying with the Defiant. "It actually opens up many of the gravel strips which we would not normally use. With the snow build-up, most of the gravel strips are just as good as the paved ones—or better."

The Kellers have no long trips planned—yet. "We want to enjoy the fruits of our labor and simply start by using the plane for those 'let's go somewhere flights' yet to be made. And, oh yes, the home-made pie at Northway is still just as good."

An informal survey of Defiant builders who are making good progress found the builders to be eager, enthusiastic and articulate.

Lynn W. Burks, 37, is an elevator mechanic from Whittier, California; he has 1500 hours with commercial, instrument and multi-engine ratings. His other hobby is radio-controlled airplanes. He is just getting started on his Defiant, gathering 500 yards of glass, epoxy and metal parts. He is using Aircraft Spruce as his basic material source and expects to spend between 3000 and 4000 hours in the next four years to complete the ship. He expects that finishing the surfaces and engine installation to be the two most difficult projects. He will use run-out 180-hp Lycoming O-360s and rebuild them himself. Working with two partners, he built a Long-EZ in 2500 man-hours and has flown that Rutan design for 400 hours in three years. Looking ahead, he





expects a flight to the Bahamas to be his first long trip in his Defiant. "Europe would be a fantastic trip," he comments. "Also it would be interesting to enter that race from New York to Paris if it is held at that time."

Roughly one-third of the way through his Defiant project is J. Dennis Riehm, M.D., from Bowling Green, Kentucky. The 32-year-old physician has 600 flying hours and an instrument rating. He is obtaining his raw materials from Alpha Plastics and Wicks. Riehm previously built a Long-EZ in 2½ years of part-time work. After 120 hours of flying he sold it, at a modest profit. He expects his Defiant project to take between 2000 and 2500 hours to complete, and he will power it with run-out engines that he will rebuild himself. He cautions that "The Defiant is NOT, definitely N-O-T, a first-time builder's project." His bottom line: "Anything's possible with this plane!"

Dentist John P. Steichen of Downers Grove, Illinois, has 600 hours on his ASEL private certificate. The 42-year-old dentist obtained his materials from Wicks and has completed the canard and fuselage center sections—about 30% of the project, he estimates. He expects to put 2500 hours into the project and reports that backup from Keller in Anchorage has been excellent. "I find postcards better than phoning because no

major clarification has been needed." Steichen expects the most difficult part of the project will be in getting a good finish on so much surface.

"When I go engine shopping, I will have to sell my Grumman Cheeta," he explains. "However, there are lots of 320s around and there is no hurry. I will get engines according to my budget near the end of building."

Steichen spent 18 months building a Vari-Eze that was completed in 1979. "I still have it," he says, "and I cannot decide what to do with it because of product liability. I have no specific plans for trips, but I have thought about the long-range capabilities of having a two-place plane with big tanks in the rear-seat area."

"I have found that the aircraft builds very fast. So far the additional size has not been a handicap. We expect to have the airframe completed, unfinished but up on the gear, by summer. This is less than one year. The Vari-Eze took nine months. In concept, building a big, four-place twin sounds bad, but it flows out of the plans real nice. All we have left is the wings, canopy and fuel tanks."

"Also, it won't fit in my hangar so I will have to expand; but it is worth it," explains the flying dentist. "My Vari-Eze is too small; my Grumman is too slow and the Defiant will be like having my own personal DC-3. The sky of the future

will belong to the homebuilder. It is the only escape from the \$50,000 Cessna 152s. I had to pay \$125 for a rudder bracket for my Grumman. It had five rivets in it and two pieces of aluminum."

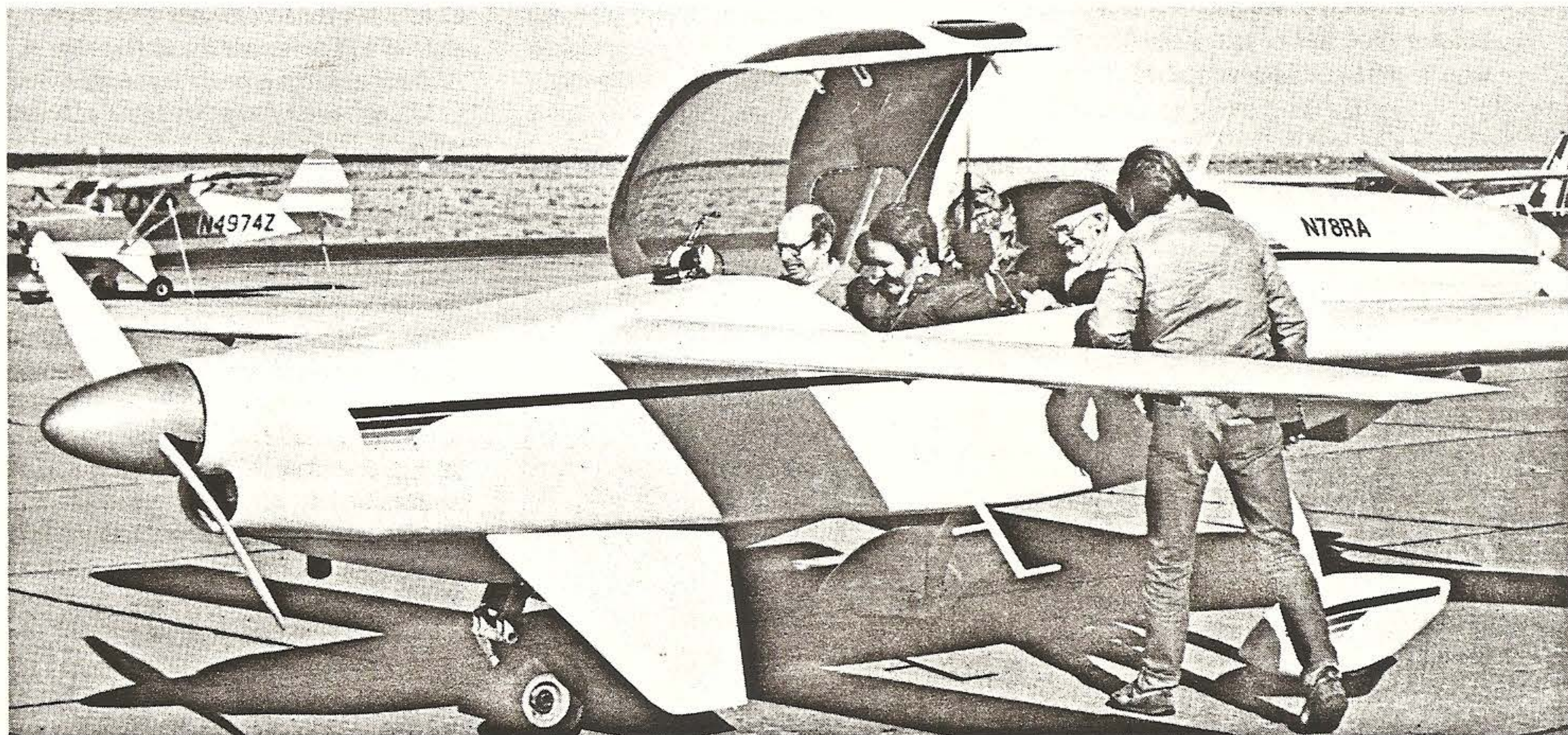
Charles Grey of Oviedo, Florida, is an Eastern Airlines 727 captain with 11,000 hours in the air; he is also rated as a flight engineer. He built two Long-EZs in two years and three days—approximately 3000 hours of work—and has sold them both. Grey is using Wicks, Aircraft Spruce and Alpha Plastics for materials; he has the wing, canard, winglets, main spar and the bottom of his fuselage completed for his Defiant.

The 50-year-old airline captain says framing the fuselage has been very time consuming. He already has a Piper Apache with 160-hp engines that he plans to scavenge along with lots of instruments, cables, parts and hydraulics. He has no plans for a long flight other than flying across the United States.

"I have enjoyed building the Defiant," Grey says. "The wings, winglets and canard are quite similar to the Long-EZ and were really no problem. We (my son and I) built four wings, two canards and

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**At the Mojave Airport, Burt Rutan gives rides in the Defiant to help with sales of construction plans.**





# BUILDERS

continued

four winglets in 32 days—that's working 10 to 12 hours a day, six days a week. The fuselage is much different and I had to make extra stringers and braces to hold the correct contour."

He also said that the EZ builders of Florida will be adding a part of their newsletter just for Defiant builders and he will be writing this part. Any input should be sent to Grey at 398 Palm Drive, Oviedo, FL 32765.

The Florida builder says his main problem to date has been in obtaining metal parts. "I understand that Ken Brock will be manufacturing some, but we need our parts now. So Lynn Woofter, a Vari-Eze builder from Ft. Lauderdale, has a machine shop and is making excellent Defiant parts." (Woofter's address is 1336 N.E., 5th Avenue, #9, Ft. Lauderdale, FL 33304; 305/462-5079.)

In his "spare time," Grey is promoting a new airport community in central Florida called The Landings. Pilots can taxi from the 4700-foot lighted runway to their 1500-square-foot custom home with a two-car garage or hangar, located 22 DME miles from the Orlando VOR on the 210° radial.

Johnny Murphy, the mayor of Cape Canaveral, Florida, is a veteran builder of Rutan designs. He was the sixth Vari-Eze pilot to fly. He built a Vari-Eze in six

months and sold it, a Long-EZ in nine months and sold it, a Quickie in four months, a Mead Adventure in a year and sold it, and a Glassair RG in 14 months that he still owns. At 57, he is a retired NASA engineer with over 3000 hours time on a private certificate with multi-engine rating. It was Murphy who met Dick Rutan near the conclusion of his record-breaking flight from Anchorage and escorted him to a landing at Grand Turk Island in the Bahamas, 4565 s.m. non-stop and non-refuel.

Murphy did not use the supplied bill of materials but did purchase his epoxy from Wicks. He says that Keller has been super. With the time difference, he must wait until late evening to call. Murphy has the wings, winglets and canard complete; the fuselage is already on the gear and he is working on the cabin glass installation. He purchased an old Piper PA-23 Apache for less than he could buy two 160-hp O-320 engines and is planning to use both gascolators, electric fuel pumps, vacuum relief valves, one prop, oil coolers and many other small parts from the Apache. His main problem to date has been finding a hangar; the canard itself is 24-feet long and won't fit in his T-hangar. He feels building the Defiant is as difficult as a Long-EZ but almost twice the work.

The bottom line for Murphy? "A trip to England is in my future!"

"I chose to build the Defiant because I fly at night and over water," says Murphy. "I don't think I'll make Oshkosh '85 because no prefab parts are yet available. I'm now trying to make engine mounts

and I'll have to make cowlings. Both are time-consuming jobs."

From Hawaii, retired USAF-pilot W.A. "Rodie" Rodewald and Rosemary Rodewald say they have used several supply houses for raw materials and their Defiant's airframe is 75% complete. Rodie overhauled the O-360-AIA engines to zero-time and estimates September 1985 for completion. He expects to expend between 2500 and 3000 hours of man-and-woman time—"30% woman-hours."

Rodie is an over-10,000-hour pilot with instrument and multi-engine ratings. Rosemary, an author, has well over 100 hours on a private certificate. "From the beginning," the Rodewalds say, "it has been shopping for the best buys, shipping them to Hawaii by the best means (cheapest and fastest) and coordination of materials so that they arrive before you actually need them that has been the most challenging part of the project."

The Hawaiian Defiant is Rodie's eighth building project and his fourth composite airplane. It's Rosemary's first project and she started with "Aluminum 101," making metal parts, and is progressing through all phases of construction. Rodie started with rebuilding a Mooney and then building a Breezy. Then came a Vari-Eze, Quickie and Long-EZ. He flew the latter from Hawaii to Oshkosh and back.

"As we live in Hawaii, our major use will be inter-island and flying to the West Coast," say the Rodewalds. "We expect that we will never use the airlines again. A European trip is on the agenda."

More than halfway through his Defiant is Dr. W. F. Yost, 45, from Sheffield, Alabama. The physician has between 600 and 700 hours on an SEL private certificate and instrument rating. He took 2½ years to build his Long-EZ which will be for sale as the Defiant is completed. Much of his supplies have come from Wicks and the doctor says that he is ahead of the supply system on parts, but sees no problems; he has had no telephone questions for Keller to date. He plans to use IO-360 engines built to automotive race/balance standards with crossover exhaust systems. Dr. Yost states, "I believe that the Defiant should only be a second or later project. It should NOT be first, at least with the present plans."

The Alabama builder is looking forward to frequent Caribbean trips to visit

**Left to right is Defiant designer Burt Rutan, second prototype-Defiant builder Fred Keller and Mike Melvill, who handles builder support.**





friends and relatives; trips with long over-water legs. Yost's progress has been so fast that RAF has been giving him construction information for the Dynafocal engine mounts over the phone as he needs it. "We never thought that anyone would be this far along so soon!" said Rutan's newsletter.

There are six Defiant builders in the Houston, Texas, area and another six throughout the state. Charles Sims of Deer Park is preparing a newsletter for the Texas contingent on a self-help basis. His address is 1918 Atlanta, Deer Park, TX 77536. Sims is a 500-hour, instrument-rated pilot whose vocation is sales. Now 41, he expects to take five years to finish his Defiant and is obtaining his raw materials from Wicks and Alpha Plastics. He reports his telephone contacts with Keller have been good and foresees the size of the parts as being the most difficult part of construction.

Sims sent letters to the Texas builders and heard back from three of them within a month. He advised the other builders, "I have purchased from Aircraft Spruce and Specialty Company a starter kit which I found very helpful. You make several small pieces to practice and weigh to understand how to use epoxy and glass. The kit is only \$49.95 and I found the project to be worthwhile if you have never worked with the material."

Sims' first newsletter reported that Byrdell Mathews had found an error in the plans calling for a #10 hole and the use of AN-3 bolts which require a #12 hole. He advised that because most of the holes should be #12 (smaller), to use that size and drill out for the larger #10 as required. Byrdell advised other Texas builders that he has built a jig for the bending part in the main wing spar and, for a contribution toward the material to build the jig, he would lend out the tool.

Sims says that "We have three (active) projects in Texas. This saves building jigs because they can be shared and also provides someone to help on the big layups. The glass work is easy to jig and getting ready to glass is where the work really is on the plane.

"Size is a problem," he continues. "For example, the wing is all over the garage, so working on more than one part is impossible unless you have a large work area. The plans are good and Fred Keller is available so there is really no problem."

Sims' second newsletter carried a run-down on the status of completed work by various builders. He wrote, in part, "I have seen Byrdell Mathews' project and he should be almost finished with the canard. His main spar weighed 32 pounds. He has all the metal parts done, all the bulkheads done and the main spar.

"Jim Yuvansic has completed all his bulkheads and main spar; he is now glassing the spar in the canard. Jim's main-spar weight is 30 pounds. He also found that the S-glass machine could be improved by reducing the friction. Jim reduced the shaft diameter on the wet out wheel to .495 and put a piece of copper tubing over the shaft to be used as a bushing. I just went to the local bearing house and purchased a 1/2 x 11/16 O.D. flanged bushing. I also added a collar to the shaft to ride against the flange bushing to hold the thrust to the shaft. These methods greatly reduce friction."

In his third newsletter, Sims was able to pass on a number of details of interest to builders.

"I spent only 2 1/2 hours helping Jim Yuvansic glass the bottom of one wing. He had already done the shear web and pulled S-glass so all we had to do was make the two-ply, unidirectional 45 layups. With four people working, it only took 2 1/2 hours. However, we do not assume that only two people could have done it in five hours. It just does not work that way.

"Be sure you have enough help to do these big layups. Give yourself enough time to get it done; do not start late at night. I know you have read all this from Rutan, but believe me it is all TRUE. Jim found out when he and his wife started a top-skin layup on his canard late one night. I can assure you he will never be so

bashful again about asking for help.

"We also used Safe-T-Poxy II on Jim's wing. It appears to wet out the glass in cooler weather better than the Safe-T-Poxy. It may be difficult to use in warmer weather or on a vertical surface, but it sure worked well on the large, flat wing surface. We also weighed Jim's canard and it was 78 pounds. You can see everyone's weight is a little heavier than Fred Keller's, so I believe the Safe-T-Poxy II will help to hold the weight down because it wets out the cloth much better.

"Byrdell Mathews has finished his canard and his weight is 82 pounds. The elevators weigh six pounds each and winglets 11 pounds each. Byrdell points out that you need to be very careful and follow the plans on the elevators. If you overlap the cloth over CS-1 tubing, you can get the elevator too thick and not have full travel. On D-2 you have two templates to get the full travel of the elevator."

There can be no doubt about it, the Defiants are coming! Introduction of this big, long-range, centerline twin to the general aviation scene will be a wild and wonderful thing to watch. Coast-to-coast flights with a single fuel stop will become routine. Direct over-the-mountains, over-the-weather routing will greatly enhance the transportation efficiency of these machines. Overwater flights to almost anywhere in the world will no longer be headline-making trips for the weekend pilot. □

**Dr. W. F. Yost of Sheffield, Alabama, is more than halfway finished with his Defiant; he's ahead of the supply system on parts, and sees no problems.**

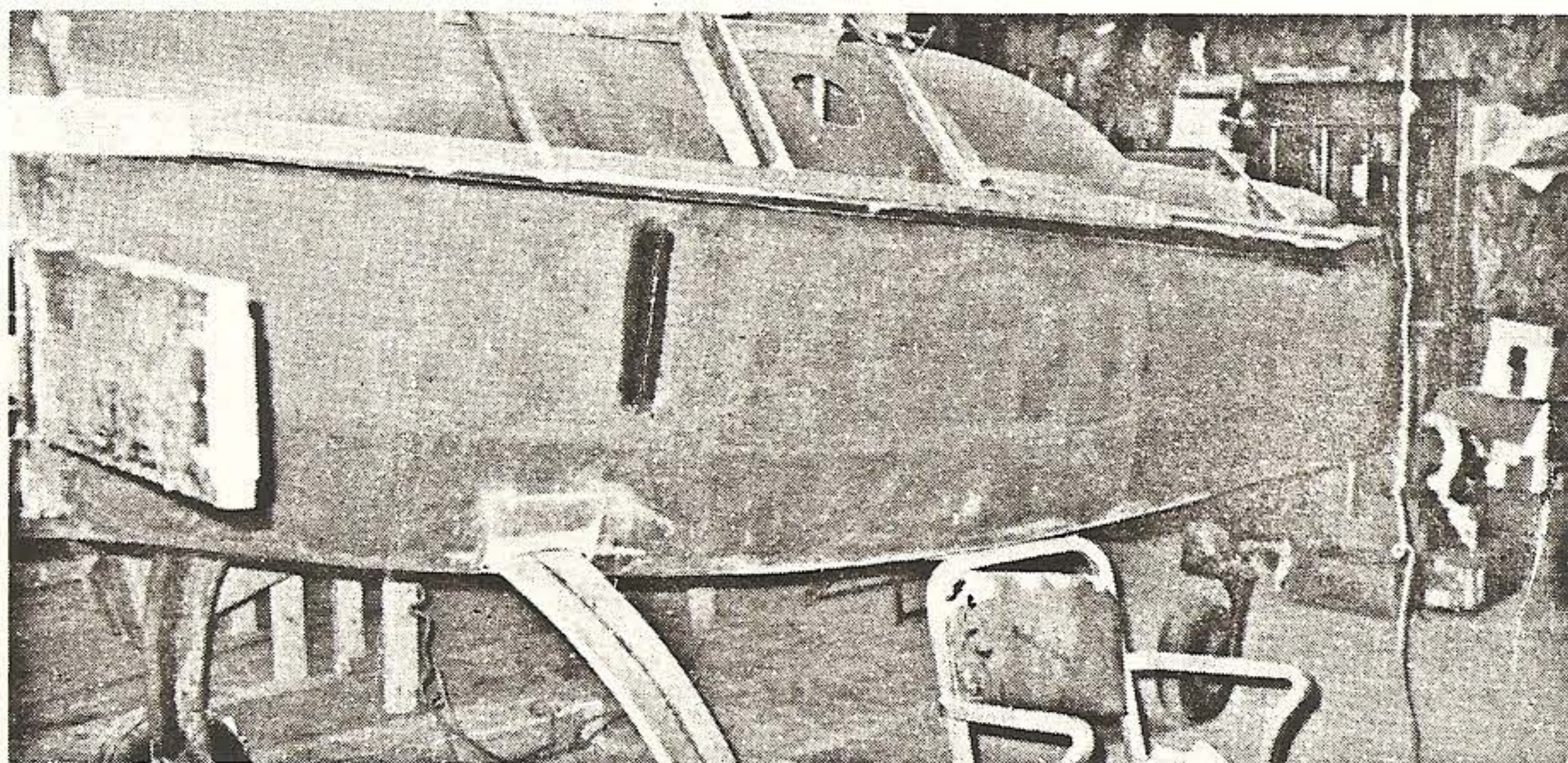


Photo: Jeannette Yost



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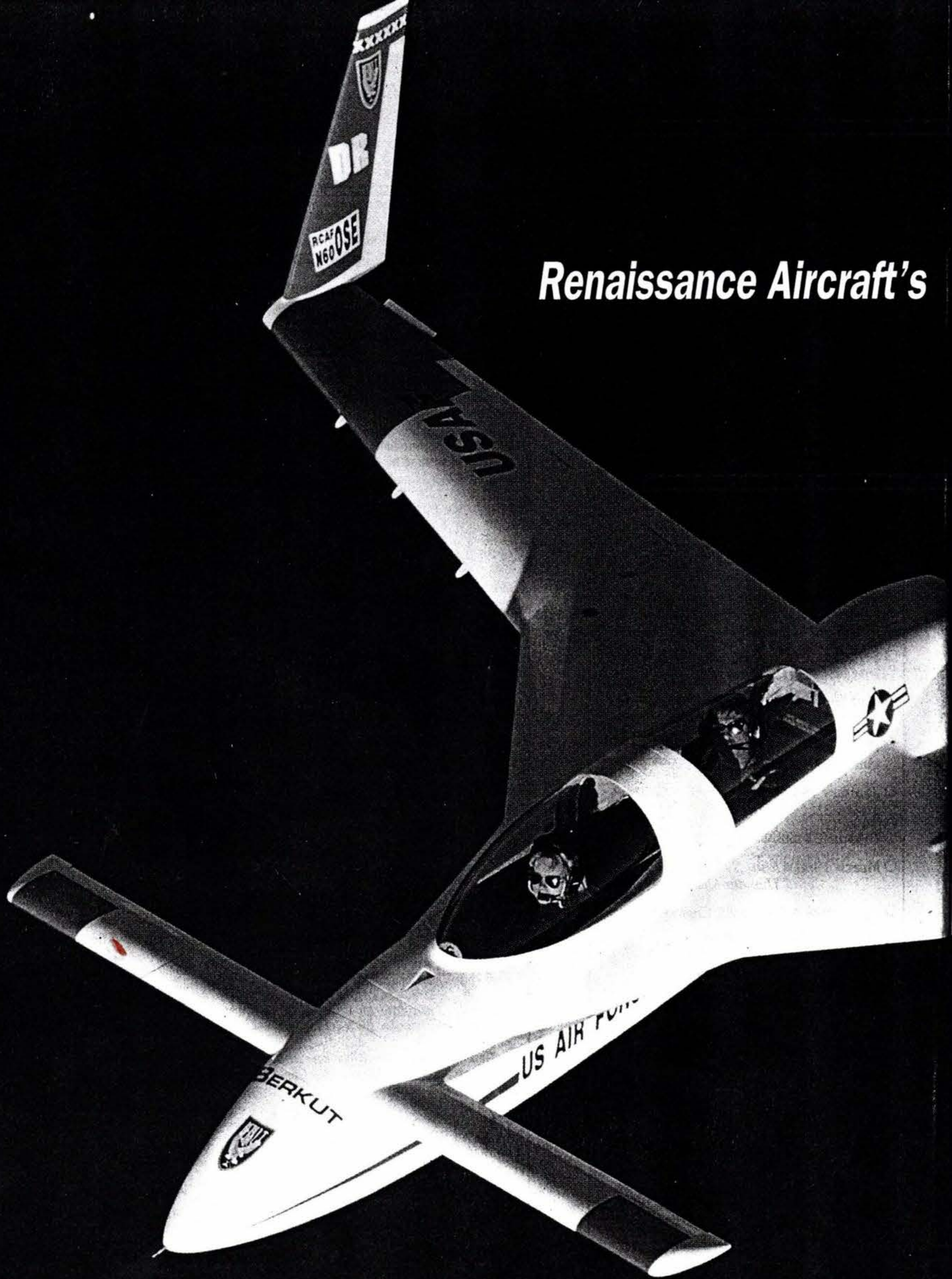
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# *Renaissance Aircraft's*





# Flying an Eagle

**Berkut takes canard airplanes to the next level.**

**By Vicki Cruse**

**W**e've all seen them, those funny-looking airplanes with no tails and an engine in the back. They have a small wing up front, a big swept main wing, tall vertical stabilizers and rudders at the wingtips, and parked on the ramp they look a lot like birds sipping at a watering hole—beak down, tail up. They are often called names such as “flying pickle fork” and “Bullwinkle” (for the famous cartoon moose).

But despite their obvious oddities they have proven capable and effective flying machines. One of the best of these designs to appear on the scene is the high-performance tandem-two-seat Berkut, manufactured by Renaissance Aircraft, Inc. in Santa Monica, California. I had the opportunity to fly this aircraft—my first flight in a canard—and it was an experience worth reporting.



Photo: Alan Staats

The new Lycoming IO-540 powered Renaissance Aircraft Berkut helped take the canard concept to the highest level.

Renaissance President Dave Ronneberg briefs the author before flying.



# Berkut

continued

Panel space is at a premium for this cross-country airplane. To cut down on clutter, a Vision Microsystems VM1000 combines multiple engine instruments into a single flat-panel display.

## A History Lesson

Canard-type aircraft have been around since the Wright Flyer, and in WW-II the Americans and Japanese experimented with canard pushers with highly swept wings and vertical stabilizers at the outboard ends of the wing. But the popular belief is that canard airplanes really came on the scene



## Berkut Bearcat!

I'd always been impressed, both with the original 200-hp Berkut, and with the people (notably Dave Ronneberg and Richard Riley) who put out the kits. In recent years, I'd also become good friends with them. Even so, I was flattered when Dave, who'd flown out to my part of Colorado to pick up a car, simply left N600SE, the second prototype IO-540-powered Berkut, at my home field with a breezy note to "play around with it as much as you like and bring it back to Santa Monica sometime in the next couple of weeks."

Perhaps Dave wasn't being entirely foolhardy. I'd had the chance for a couple of brief flights with him back at Santa Monica a few months before, during which I even managed a few creditable landings, *sans* rudder pedals, from the back seat in preparation for demoing the ship to foreign dignitaries, as well as some subsequent front-seat time with Dave and alone.

I'd never really had the chance, though, to use the airplane where it really shines: for a long, high-speed cross-country. Now I was looking forward to those 570-odd n.m. over some of the most scenic country in the Southwest—a flight the Berkut should make in almost exactly 3 hours.

## Getting In

There are some significant differences from the prototype 200-hp airplane, which was lost in an apparent G-

LOC (G-induced loss of consciousness) accident at an airshow a couple of years ago. One of the most welcome changes is a new electric actuator for the nosegear (the mains remain hydraulic).

Now, rather than attempting the butt-first leap onto the wing perfected by Dave but difficult for those either shorter or less "jocular" than he, one can board comfortably with the nose of the airplane on the ground. In fact, the engine can be started in that attitude. Then, with the flick of a switch (and an optional cry of "hut-hut-hut" *a la* Peter O'Toole in *Lawrence of Arabia*), the airplane rises gently to its feet, ready to taxi away. Looking around the cockpit also reveals the absence of the big handle for the belly-mounted drag brake; it's now deployed electrically and controlled by a switch on the F-16-like right-hand side stick.

## Launch Prep

I made sure to switch on the electric boost pump before takeoff; the first six-cylinder Berkut prototype was totaled in a forced landing on its second flight, due to a failure of the engine-driven pump. Normally, Dave Ronneberg cringes at the idea of a static full-power runup, since it sucks gravel into the wood prop, but given that my home field lies at 9086 feet MSL, I felt it would be justified for a brief moment. With the engine leaned to optimum, the Berkut turned up 2160 rpm due to the combination of high density

altitude and a rather aggressively pitched (91-inch) cruise prop.

Not that this hurt climb performance much; with all three wheels in the wells at 120 knots, which is faster than optimum, and with full fuel (or so I thought) and about 40 pounds of baggage strapped into the back seat, we still went though 12,000 feet MSL at better than 1000 fpm. Little did I know that the airplane was getting progressively lighter: I'd failed to secure one of the gas caps properly, and with the airplane pitched to climb attitude, the fuel filler was well below tank level.

At least in Berkut, unlike some of the earlier Ezes, the fillers are outboard of the prop, so if a fuel cap comes off, that's all you lose (rather than a prop blade as well). I didn't even know I'd lost the cap, apparently right on takeoff, although weeks later a friend who'd been hiking in the area told me, "I saw you take off in some kind of weird jet, but were you having engine problems? The contrail was coming from only one side..."

## Cruisin'

Leveled at 12,500 feet on a warm September day, the Berkut steamed along at what worked out as 213 KTAS at a very conservative 2500 rpm. Ronneberg habitually cruises at 2700 or more, which allows him to use full throttle at relatively low altitudes; as it was, I was pulled back to about 16 inches of



due to the efforts of designer Burt Rutan.

Rutan's first design was the VariViggen, which went to the drawing board in 1961 and first flew in 1968. This aircraft was a small, tandem two-seat craft built of wood with a delta wing and retractable gear. Only a few were built, and the airplane was not very popular. Rutan started experimenting with a speed-wing version of the VariViggen, and what evolved was the VariEze, introduced in 1974 and awarded Outstanding New Design at Oshkosh that year.

The VariEze used a Continental O-200, the same engine found in a Cessna 150, and plans were made available in 1975. The airplane had fixed main gear and a retractable nose gear. This was the beginning of the canard aircraft we recognize today, and additional designs would soon follow.

After the VariEze came the Quickie in November of 1977. A small, single-place aircraft built from

mercury, some 2 inches less than what I might have gotten at full throttle.

Even with 91 inches of pitch, I had the impression the airplane was a bit "underpropped" for its power—although had I wanted to head up to oxygen altitudes I could have realized an impressive combination of cruise speed and economy. The ride was solid and comfortable, and once trimmed up the airplane could be left alone for long periods of time as Monument Valley, Lake Powell, and the Grand Canyon slipped past.

As is common with Berkuts, the last time I'd had my feet on the rudders was during takeoff. *Goose*, in particular (its N600SE registration commemo-

plans, it did not have winglets like the Eze but was a tandem-wing aircraft with both wings the same size. A true biplane, 60% of the weight was on the forward wing. It was originally powered by a tiny 27-hp Onan engine. Like the VariEze, this platform spawned its own line of descendants—the side-by-side Q2, the Continental O-200-powered two place Q-200, the tricycle-gear Tri-Q, and the larger two-place Volkswagen-powered Dragonfly. Rutan even designed a racing version of the Quickie, the Amsoil racer, for the biplane class.

In June 1978, a variant of the VariEze, the Defiant, was introduced. It was originally designed for production, though plans were later dropped. Resembling a larger VariEze with an engine in the front and back, it seated four. A long-term build-

Painted in Air Force trainer fluorescent orange trim, Berkut shows SoCal ground-bound traffic how it's done.





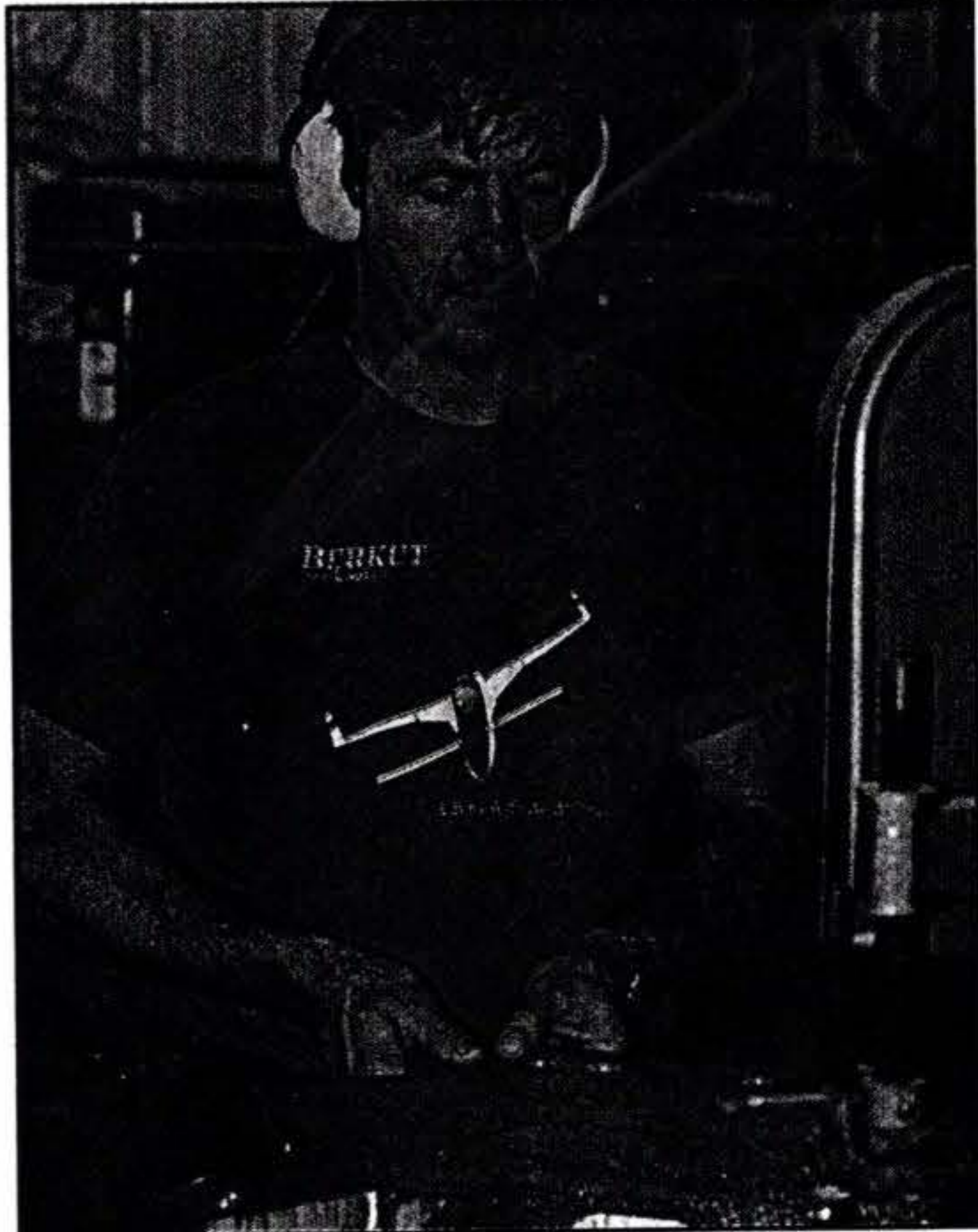
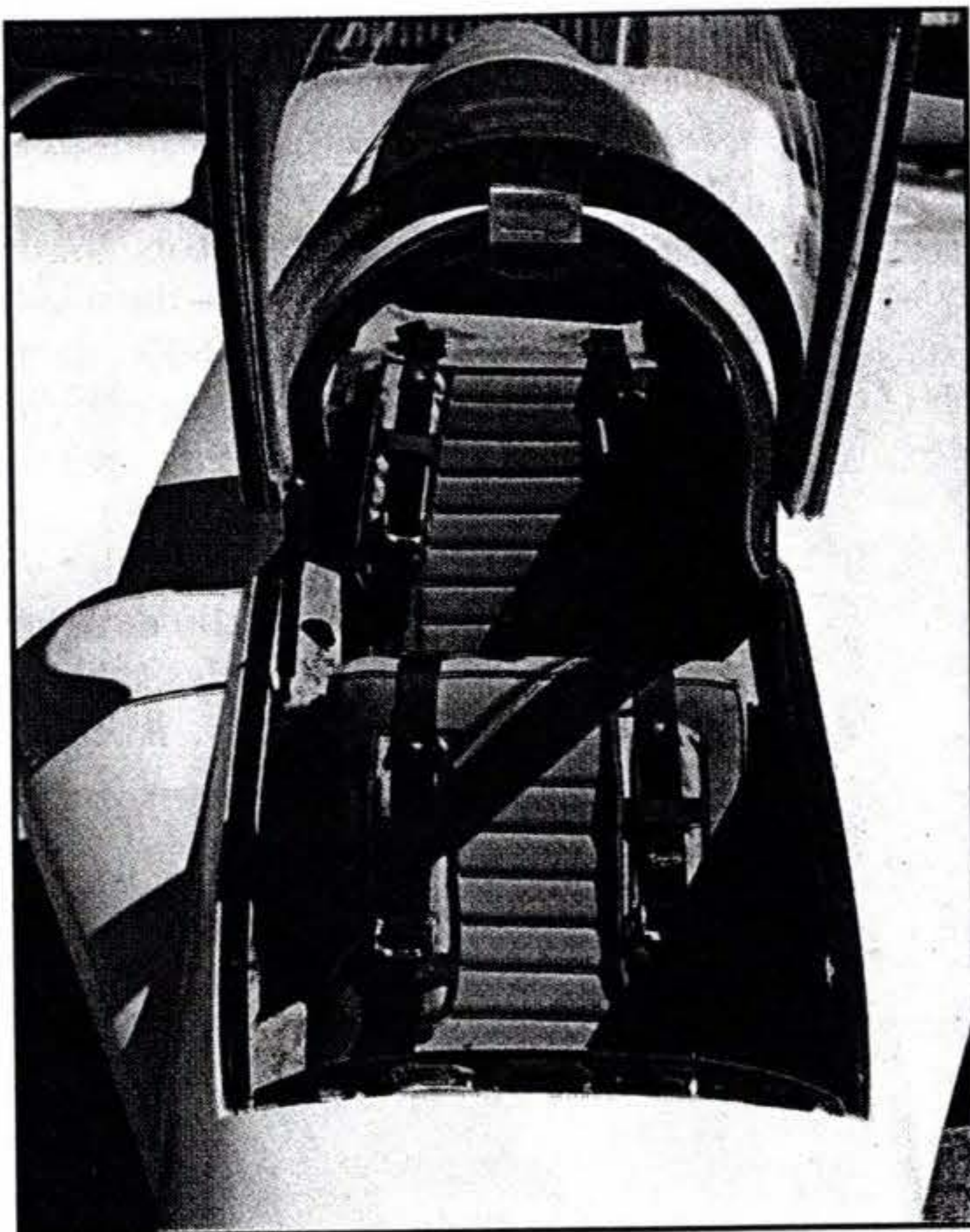
# Berkut

continued

The tandem cockpit is snug but comfortable.

ing project, few Defiants were built.

Seeing a need for a more practical bird, Rutan went back to the drawing board and redesigned the VariEze, and in June 1979 he was back, this time with the Long-EZ. The Long-EZ was 15% larger than the VariEze, and it



# Bearcat

continued

rates the Navy callsign of Cdr. Rick Fessenden, who lost his life in the prototype's airshow accident), has a roll trim change with respect to airspeed—one I haven't experienced in other Berkuts. Rushed to completion after the loss of the first big-engine airplane just in time to make Oshkosh 1996, it's visibly out of rig. Even so, a flick of the stick-mounted roll trim switch straightens things out in short order; and by the time you read this, "Goose" may have received a set of the new carbon-fiber-skinned wings.

## Soaring, Anyone?

I'd been keeping track of fuel consumption primarily by the digital display in the Vision Microsystems VM-1000 integrated instrument package, of which more shortly, but also by occasionally swivelling my head around to look at the two sight gauges on either side of the back seat. As I expected, the level of the tank I was using gradually decreased. Also as I expected, the gauge on the other tank was the solid light blue of 100LL, with its actual surface above the top of the gauge...or so I thought. Actually, what I was seeing was the residual color that had soaked into the plastic tube. A bit south of Las Vegas, with the tank I'd been using down to about a third, I switched to the other...and things got rather quiet.

It didn't take the engine more than a

week or so to restart when I switched back to the original tank, and it was at this point, leaning forward and craning back to see the top of the fuel tank, that I realized what had happened. The GPS revealed plenty of airports nearby (as well as the fact that the nearest didn't have any fuel); soon I'd landed at Henderson, Nevada, to tank up.

Merely refilling the tank for which I still had a gas cap would have been sufficient to get me to Santa Monica; for extra security, I put a few gallons in the capless tank, finished my Coke, cut off the bottom of the can with my trusty Swiss Army Hospital, jammed it into the filler neck, and covered it with several layers of *The Force*, also known as gray tape ("...it has a light side, it has a dark side, and it's what holds the universe together").

## Display Trouble

Taxiing out at Henderson, the engine instrument display froze up solid. Switching it off and back on brought it back to life but made me wonder if the trouble would recur (it did, but the same procedure worked again). The trouble was later traced to a ribbon cable kinked during installation, rather than a problem with the system itself or any of its sensors, but it makes one stop and think. There's no question that digital electronics are more rugged and more reliable than the mechanical or electromechanical dials

we're used to—but a system like the VM-1000 puts all your eggs in one basket.

Since the problem was clearly gauge-related, and the engine had been running fine, I elected to press on to Santa Monica, now only an hour or so away. With a field elevation almost 7000 feet lower than my departure from Telluride, the Berkut shoved me back in my seat, then leaped off the ground and headed eagerly for the forbidden territory of the Las Vegas Class B airspace lying just above.

The remainder of the trip was uneventful, although the Garmin GPSMAP 195 was invaluable in finding my way through the Los Angeles haze without running into any of the various special-use airspace segments (while freeing me to keep my eyes outside for other aircraft). The electric drag brake on the belly was a big help in slowing behind Santa Monica's usual swarm of C-152s practicing flight at minimum speed on 5-mile final. It's a bit disconcerting to use until you're used to it, however: Because it blanks off a good deal of the airflow to one half of the propeller disk, it makes the engine feel like it is running rough.

## Choosing

Would I choose the big engine if I were a Berkut builder? That's a hard one to call. There's no question that it climbs better and cruises faster—but until some-



## Ronneberg machines parts for Cruse's custom rudder pedals.

used a Lycoming O-235 or O-320. It too had fixed maingear and a retractable nosegear. The Long-EZ would become one of the most popular homebuilt airplanes ever designed, even though the aircraft was never offered in kit form. Long-EZs were built from plans, although a few molded and metal parts were available, as well as materials kits from aircraft supply companies. Complete kits as we know them today were not offered.

The Long-EZ was the last homebuilt canard design from Burt Rutan, though he went on to design the globe-circling *Voyager* and other airplanes. But even after Rutan left the homebuilt scene, others picked up where he left off. A number of canard aircraft have been

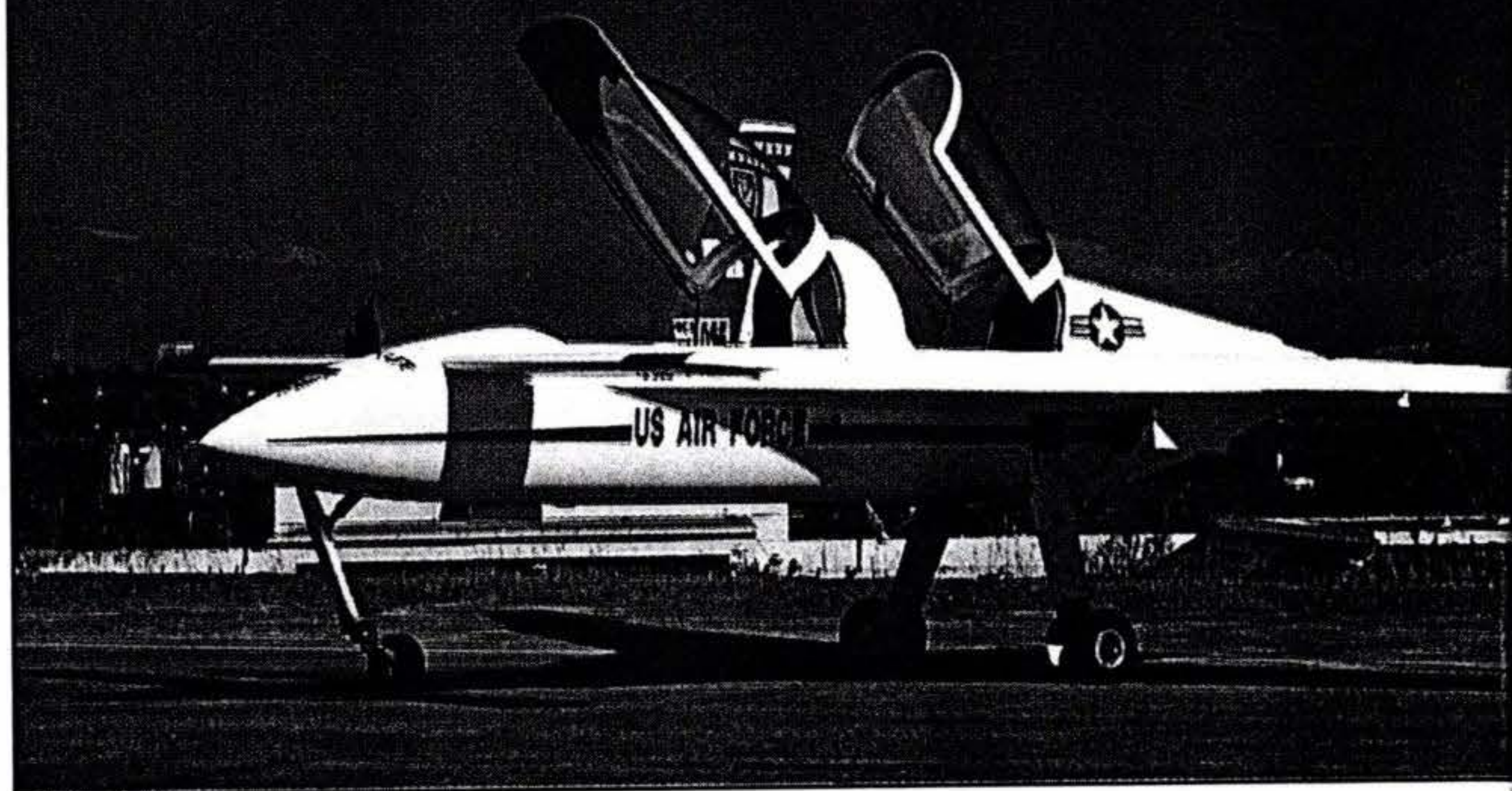
one figures out how to repeal the laws of aerodynamics, it only cruises 12 to 15% faster, while burning up to 50% more gas.

There's no question, according to Dave and Richard, that it's way harder to install, and all that weight back there requires careful attention to c.g. Why use the IO-540, then? Well, there are some builders who simply want the performance of the Berkut TS (it stands for *testosterone*); and, paradoxically, one can often find IO-540s for no more, or even less, than comparable IO-360s. (The great proliferation of 200-hp production lightplanes, as well as homebuilts, has put used -360s at a premium.)

Personally, I'd probably still prefer the IO-360—particularly because its lighter weight might allow installation of an (admittedly costly) Hoffmann or MT composite constant-speed propeller. With that, performance would approach that of the -540 powered airplane, while fuel efficiency would be better. And who knows? We're all still waiting for the 300-hp Zoche turbocharged aerodiesel, which will burn jet fuel and weigh even less than the IO-360. But until then, the Berkut—with either engine—continues to match unparalleled handling with performance at the high end of the available range.

KP





## Berkut

continued

introduced, including the three- and four-place Cozy, the four-seat Velocity, Shirl Dickey's speedy E-Racer, the German-built Speed Canard, the new four-seat SQ2000, Steve Russel's four-place Aero Canard, and the Renaissance Berkut.

### Bucking Convention

The original premise behind the canard airplane wasn't to have people stand in awe at the sight of a row of odd-looking, awkwardly parked aircraft. No, the main reason for these designs was to design an aircraft that did not stall as conventional aircraft do, and also to use the canard's aerodynamic strengths to increase performance. Because safety is always first in most pilots' minds, and since a canard airplane's main wing doesn't stall, the canard airplane won't spin, making all who fly in them breathe easier.

The canard airplane does this via aerodynamics and geometry. The canard wing is the horizontal stabilizer and elevator mounted up front. Its airfoil, and the angle of incidence at which the canard is mounted, determine the critical angle of attack, or stall speed of the canard wing.

This is all set so the canard stalls before the main wing does. For example, when the nose of the aircraft is pitched up and reaches the canard's critical angle

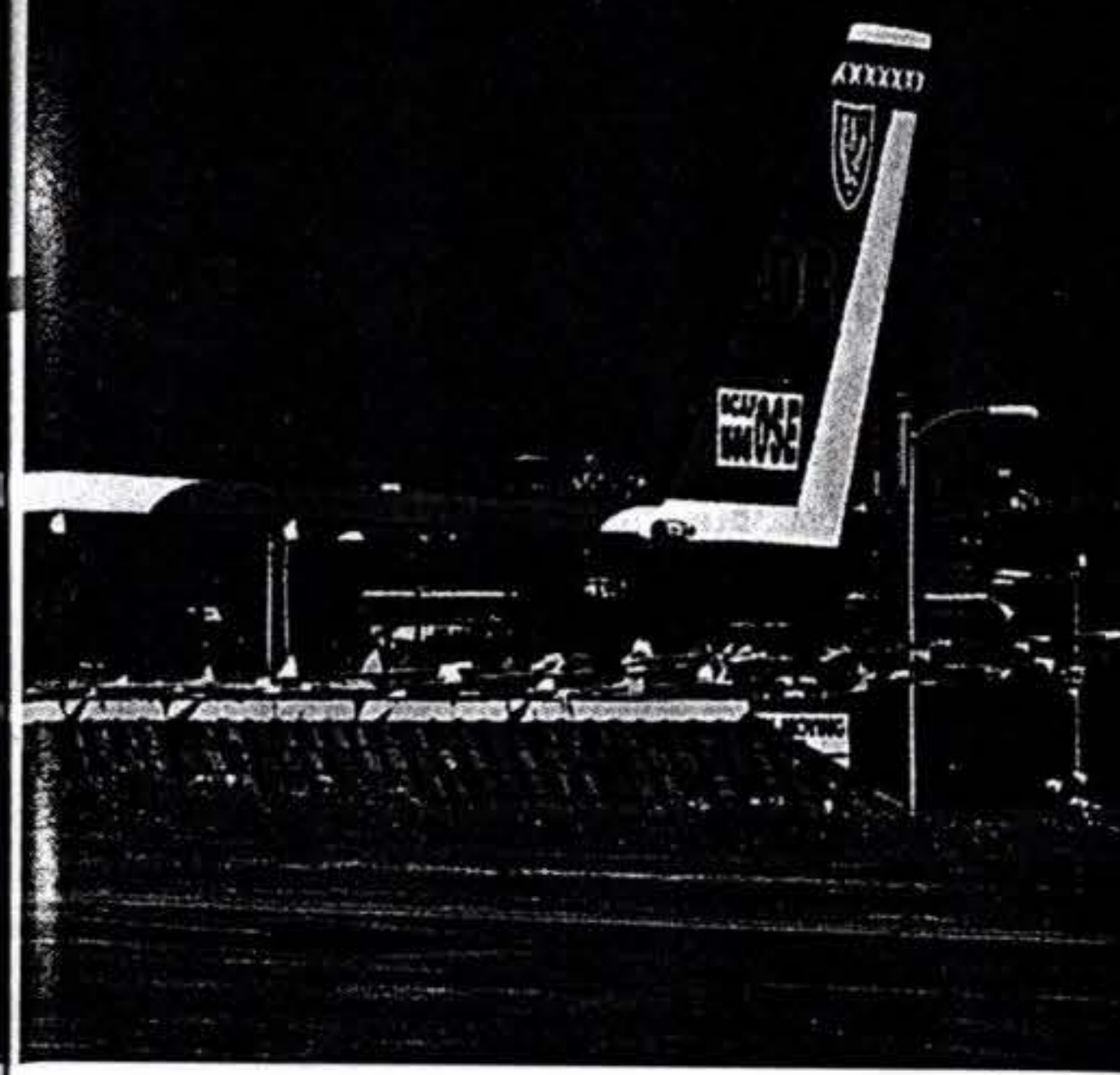
of attack, it will stall while the main wing is still flying. At the stall, the canard's elevator no longer produces pitch input, so pulling back on the stick does nothing. The nose then drops slightly, which reattaches flow to the elevator. Keeping the stick back starts a safe, stable, rocking-horse motion where the nose of the aircraft bobs up and down slightly, but the main wing never stalls.

But there can be problems. Some pilots cite the canard's potential to enter a deep stall as a major fault of these aircraft and a reason to never fly in one. A deep stall is a non-recoverable stall of the main wing. How can this occur in a canard aircraft if the canard stalls first and there is no elevator authority to continue to the nose-up attitude? The answer is to load the aircraft aft of its critical c.g.

Early Long-EZs using an O-320 or O-360 have to watch the flight envelope carefully, and weight often must be added in the nose. This is why EZs and other related tandem canard aircraft are flown solo from the front seat. But deep stalls are not just limited to canard airplanes. Conventional aircraft are subject to similar unrecoverable modes when loaded with a too-far-aft c.g.

### A Different Bird

In the late 1970s and early '80s a man named Dave Ronneberg got the home-building bug. Working for Tom Aberle at Compton Airport near Los Angeles, he helped build a Starduster II, several Pittses, a Mong Sport, and he helped



Dual tandem canopies give the Berkut a fighter-like appearance on the ramp.

restore a Stearman. On his own he built a Lancair. A fan of composite construction, he built seven Long-EZs. During the building process he noted what he would like to change and incorporate into one special airplane.

The top items on his wish list were construction molds for the EZ. Each Long-EZ required what was effectively a new pattern, requiring that each airplane be shaped, filled and surfaced to perfection. Ronneberg figured if molds were used, duplicate components could be created allowing for a time savings of several hundred hours. Being a fairly tall guy (6 feet, 2 inches) he also wished for more headroom and a longer, wider fuselage. As the saying goes, be careful what you wish for you just might get it.

In 1986, Ronneberg started fulfilling his wishes. Sam Kridell, head of space shuttle design for North American Rockwell, used a Cray supercomputer to produce a set of full-size templates of the fuselage and bulkheads that Dave had designed over the previous five years. Using these templates, a full-size model of the fuselage was built. It was also around this time that Dave was involved with Rutan and the *Voyager* project. The fuselage model was shelved but not forgotten.





## Berkut

continued

### The Berkut Is Born

While working for Rutan, Dave continued to dream about his airplane and noted additional changes he would like to see in a canard aircraft. He also toyed with the idea of producing kits instead of an airplane built from plans. Over the next few years the dream became a reality. In 1989 construction began on the prototype bird, now called the Berkut. If you're wondering, a Berkut is a small but vicious predatory Eagle bred by the Kirghizia tribesmen of south-central Russia to hunt wolves from horseback.

The prototype airplane incorporated new features into the canard body. The model of the fuselage built in 1986 was 12 inches longer, 3.5 inches wider, and provided 4 inches more headroom than the Long-EZ. These features were retained in the prototype Berkut. This airplane would emerge with fully retractable gear, designed by Shirl Dickey, designer of the E-Racer. Ronneberg acquired the rights to use Dickey's gear in the prototype and future Berkut kits.

Dickey continues to manufacture the carbon fiber gear for the Berkut. The prototype Berkut used a Lycoming IO-360 engine by Demars rated at 205 hp. Light Speed Engineering's Klaus Savier designed the electronic ignition, which retains a traditional magneto backup.

The Berkut differs from the EZ in a number of other ways. The canopy of the Long-EZ is a single-piece unit, whereas the Berkut canopy is two pieces—a canopy for each person similar to those used on modern two-seat-tandem fighter jets. The

Berkut ailerons are 6 inches longer than on an EZ and have a slightly larger chord. The lower winglets and rudder horns have been eliminated by incorporating them into the wing on the Berkut. The strakes (the triangle portions between the fuselage and wing) have a convex upper surface instead of the flat surface found on the EZ.

The Berkut also makes use of carbon fiber and Kevlar in the design. Carbon fiber is found in the canopy frame, wing skin, and in the mainwing spar caps and the canard spar caps. Carbon fiber is stiffer and stronger than fiberglass, and in its Berkut application it prevents unwanted flexing, particularly in the wing, making for a much more rigid wing with no weight penalties. Kevlar is used in the belly, under the glass outer skin, to protect the underlying skin in the event of a gear-up landing.

The prototype Berkut was completed in the summer of 1991 and flown to Oshkosh. The reception was outstanding, but Ronneberg was not ready to sell kits just yet. He used the next year to acquire the financing, tooling, and materials necessary for producing a kit, as well as writing a construction manual. At Oshkosh 1992, orders were taken for kits, and deliveries began in January of 1993. Despite the success at Oshkosh, the return home found a financial partner who wanted out of the airplane building business.

According to Richard Riley, vice president of Renaissance, a buyout was agreed upon prior to Oshkosh 1992, but in late '92 the financier changed his mind with regard to the terms of the buyout. A lawsuit resulted, and then, in mid-1995, Rick Fessenden, the company test pilot and airshow pilot, crashed in Santa Paula, California, in the prototype Berkut. Months later, a judgment in the lawsuit was made providing for the financier



## **Cruse takes the driver seat for one of her first flights in a canard.**

to receive a lump sum payment that represented the return of his investment. Ronneberg could not make the entire payment and began planning for bankruptcy.

Vendors with outstanding accounts were paid and all outstanding kit segments were finished and delivered. Experimental Aviation filed for Chapter 7 bankruptcy and under the protection of the bankruptcy court, the final judgment for the lawsuit filed by the financier was never made. With the company in Chapter 7, Ronneberg and Riley continued to provide customer support and constructed composite parts for use outside the aircraft industry.

They could not, however, sell kits. In April 1997, the assets of Experimental Aviation, namely the molds, were awarded to Ronneberg and company. Renaissance Composites was formed, and the sale and delivery of kits resumed.

### **The Test Ship**

The Berkut I was scheduled to fly is based in Santa Monica and is owned by Mishka Kasyan. It is equipped with a 260-hp IO-540. The idea for using a IO-540 in a Berkut had been in the back of Ronneberg's mind since 1991, but nothing became of it until a builder, wanting to use the Berkut for airshows, decided to install an IO-540. Ronneberg provided the cowlings and other necessary parts. Unfortunately, this airplane's mechanical fuel pump seized and the airplane crashed on a highway just off the Santa Paula airport. Fortunately, no one was killed. The IO-540 is now an option for the Berkut and promises to be more popular than the O-360.

The IO-540 turns a Klaus Savier fixed-pitch propeller 67 inches in diameter, with a whopping 105-inch pitch (the IO-360 prop has a 91-inch pitch). The pitch of a propeller is the theoretical distance it would travel forward in one revolution if there were no slip. Therefore, the higher the pitch the bigger the bite of air taken by a prop. This translates into speed. Fixed-pitch propellers can be of three types: climb, cruise and standard, which is a happy medium between the other two. So the higher the pitch, the faster the cruise speed—but you'll need a longer takeoff distance. For comparison, the pitch on a typical Cessna 152 prop is 58 inches with a diameter of 69



inches. The prop on the Berkut was designed for cruising fast, and its small diameter in relation to pitch means it turns very fast and grabs a lot of air. On the ground the Berkut's prop limits the engine to 2000 rpm, but rpm builds rapidly as the speed comes up. Full throttle produces 2900 rpm.

This airplane is equipped with a Vision Microsystems Engine Monitoring System, navcom, GPS, autopilot, transponder, and the standard instruments. The panel is small compared with panels in side-by-side seat airplanes, so the Vision Microsystems functions and display are ideal. All of the instruments and switches are easily reachable and none are blocked from view. The fuel selector is low and between your knees, but easily reachable.

## Flying It

Dave Ronneberg ran me through the systems of the airplane, a thorough pre-flight, and then went over the emergency procedures before we went flying. The nosegear uses a unique jackscrew that allows the nose to raise and lower while parked, with a pilot in the cockpit. This unique feature is an attention-getter on the ramp. The main gear uses an electro-hydraulic system, protected by an airspeed sensing cut-out switch. In the air all three gear work together, activated by a single up/down gear switch, but on the ground the switch only controls the nosegear. Once seated in the airplane, the nosegear is lowered, and the bowing Berkut now takes on the flying stance. Once at your destination, make sure the nosewheel is straight by looking through a small window between your knees, retract the nosegear and get out of the airplane. OK, OK so how does it fly?

I was fortunate enough to get three flights in the Berkut, and I have my size to thank for it. The factory Berkut is not set up for people 5-foot-2 to fly, therefore my first visit was to take a look at the manufacturing facilities, ask a lot of questions, and be measured for a set of rudder pedals Ronneberg would make for me.

My introductory flight was from the back seat, which includes a throttle and stick but no rudder pedals or instruments. Getting into the back cockpit requires a bit of a hop, butt first onto the strake then swinging your legs into the cockpit. Yet it's roomy, comfortable, and legroom is

## A Bird of a Different Color



**T**he airplane tested for this article has a unique paint job with dayglow orange vertical stabilizers and wingtips and the stars and bars of the U.S. Air Force. It's modeled after the F-15s and -16s of the test squadrons at Edwards AFB, but this Berkut is no wannabe warbird.

Every student who graduates from the Air Force Test Pilot School at Edwards must fly and evaluate 30 different aircraft during the six-month term at the school. The planes range from helicopters to fighters, the Stearman biplane to the P-51, a Taylorcraft to a T-6, from business jets to the lumbering Shorts cargo turboprop (think of a step van with wings). The Air Force can't keep that diverse an inventory just for student evaluations, so the school brings in privately owned airplanes to fill in the gaps and widen the student's experience.

Like an Air Force Reservist, the Berkut puts in two weeks per year training the next generation of test pilots. In return, the school gives the owner a "fam" or familiarization flight in the back of one of their airplanes. In the past, Berkut designer Dave Ronneberg has flown in an F-15, and office manager Diane Moser got a ride in a T-38. This November, the Berkut 540 will be making its first trip to Edwards, and owner Misha Kasyan will ride in an F-16.

The photo above is not a computer composition. The pilot of the F-16 is Berkut builder and Edwards TPS instructor Maj. Norman Howell, taking his last flight as an active duty Air Force officer. He's now a reservist and flies full time as a C-17 test pilot for Boeing Tanker and Transport division. The photo was taken from a Lancair IV-P flown by Doug Witeman. —Richard Riley

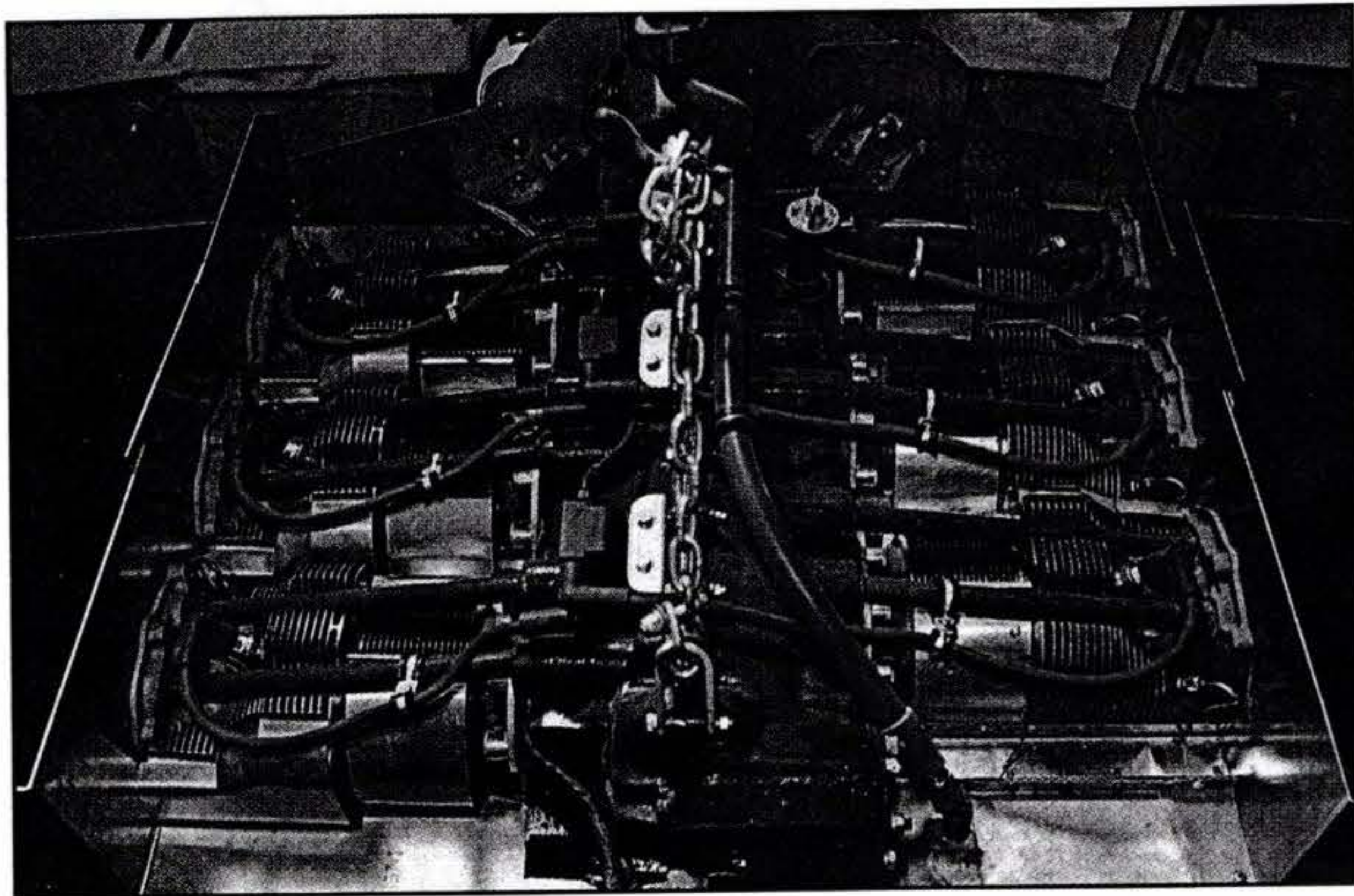
plentiful. A four-point harness is installed in this aircraft. One of the biggest complaints about the EZ family is baggage space; the Berkut also has this problem. Baggage may be placed in the strakes, which are quite cavernous but only 8 inches tall at the opening. With two people on board, baggage can be placed at the feet of the backseat passenger since there are no rudder pedals to contend with.

This flight showed the power of the Berkut and allowed me to get used to the stubby control stick on the right arm rest. The backseat passenger in this particular airplane does not have a trim control, so changes must be conveyed to the person in the front. Builders, however,

may opt for trim on the back control stick. Trust me, trim is necessary on this airplane. Your wrist gets tired fast if you don't trim the airplane. We attempted a few landings to get me used to the speeds involved and the orientation of the airplane in the pattern. From the backseat I couldn't see the instruments, nor could I see out the front very well.

Next we flew the airplane to get used to what it feels like; essentially the feeling is fast, very fast. We went through the stall series and since this was my first time in a canard aircraft, it was interesting to feel what a canard stall is really like. The best comparison I can make is much like a rocking chair. At the stall





The six-cylinder, fuel-injected Lycoming IO-540 provides plenty of power.

## Berkut

continued

the nose visibly drops about 2 feet, and if you keep the stick back it comes back up again and then drops until you release the back pressure and fly away. One cycle of nose up and down takes about 2-3 seconds. Power-off stalls will result in an altitude loss of less than 50 feet through two cycles or bobs of the canard. Add in a little power—1200 rpm—and no altitude is lost. You can slowly turn the airplane in the stall configuration, but the controls are more mushy than in normal flight, as they are with most airplanes. With the first flight under my belt we flew back to Santa Monica and I awaited word to come back and try out my new rudder pedals.

### Front Seat Anxiety

I must admit, I almost dreaded the day I got the call to come back to Santa Monica and try out the pedals. I went back knowing that I was going to have to fly the Berkut from the front seat and that Dave, sitting in the back, would not have rudder controls, brakes, avionics or instruments. I was intimidated by this airplane from the start: It's fast, really fast. I haven't flown 1000 different airplanes nor do I have 13,000 hours, so if I could fly this airplane then most pilots ought to be able to as well, which was part of why Dave was giving me that seat...to prove a point.

I currently fly a Christen Eagle, and more than half of my 400 hours is in that airplane. Dave told me that I would have no trouble flying the Berkut. He also said there was no way he wanted to

fly my airplane in exchange. It turns out the two airplanes have some things in common. The pattern speeds are identical, both have no flaps and are slowed on touch down by bringing the nose up. Still, I had a lot of anxiety going into the first flight from the front seat. The rudder pedals built for me were 14 inches in front of the existing pedals and connected to them with a steel tube. The pedals in the Berkut are slightly different from the norm; they are independent of one another. Pressing on the right rudder does not move the left pedal at all, and the rudders only swing outward of the winglets. For brakes, keep pressing the pedals and the brakes take effect just as the rudder hits full deflection. Although it sounds a bit strange, it takes only a few tries at braking to get used to it. In addition to modifying the pedals for me, about 35 pounds was added to the nose to compensate for the c.g. shift with me in the front. The Renaissance crew went to a lot of effort to make this airplane flyable for me.

### Flying It from the Front

After putting a few cushions in my seat and strapping in, the next task was starting the airplane. Crack the throttle, mixture full forward, turn on the magneto, flip on the battery, and push the start button. If it cranks six times before starting, stop, turn on the boost pump for about two seconds, open the throttle a bit more, and hit the start button. Once it fires, turn on the electronic ignition, throttle back and you are ready to raise the nose. Flip on the master switch and lower the nosegear. The nose rises to full extension and stops.

The airplane taxis with ease and get-

ting used to the brakes is a piece of cake. Steering is by means of a full-castering nosewheel and differential braking on the mains. The runup is done on the fly because the prop has so much pitch that if you run it up while standing still, it will suck up rocks (or even sand) and blast the surface of the prop, especially the leading edge. That's also the reason you start the beast with the nose down. Since there is no constant-speed prop, a simple mag check is all that's needed. A check of the engine instruments and everything is ready to go. Pull up to the hold-short line, lower the canopies, latch them and you're set.

### The Eagle Takes Flight

Dave told me I'd need a little right rudder on takeoff but advised that I use it sparingly. We were cleared for takeoff. On the centerline I pushed the throttle about half way to avoid sucking rocks into the prop. At about 40 knots, full throttle is applied and I applied a bit of right rudder. Rotation occurs at 70-75 knots, and the climb is steep. Rudder inputs were unnecessary from here on out. In about one and one-half minutes the airplane had quickly climbed to 4000 feet, and the throttle was brought back to 2700 rpm. I lowered the nose and started trimming the airplane using the switch on the stick. We were at 200 knots quickly and ready for smooth flying, tremendous visibility flight.

Once trimmed, the airplane is easy to fly. It doesn't take long to get used to the side stick on the right. In addition to the trim button, the stick also includes the push-to-talk and a switch to raise and lower the belly brake. Dave suggests holding the stick from the base and resting your arm on the arm rest. This takes away the tendency to overcontrol the airplane. Rolling the airplane from side to side is easy. The sensitivity of the control is not overly light and it's not hard, but just right. Pitch, on the other hand, is less sensitive than roll. When attempting a tight turn you can feel the stick forces increasing the more you pull. In a 360° turn, the tendency is to begin to let off the pull because your arm gets tired. This stability characteristic is brought over from the Long-EZ and allows for a lower workload. This is especially nice during cross-country flights—a forté of the Berkut.



**Flying the Red Rocket: Ed Swearingen's SX300**

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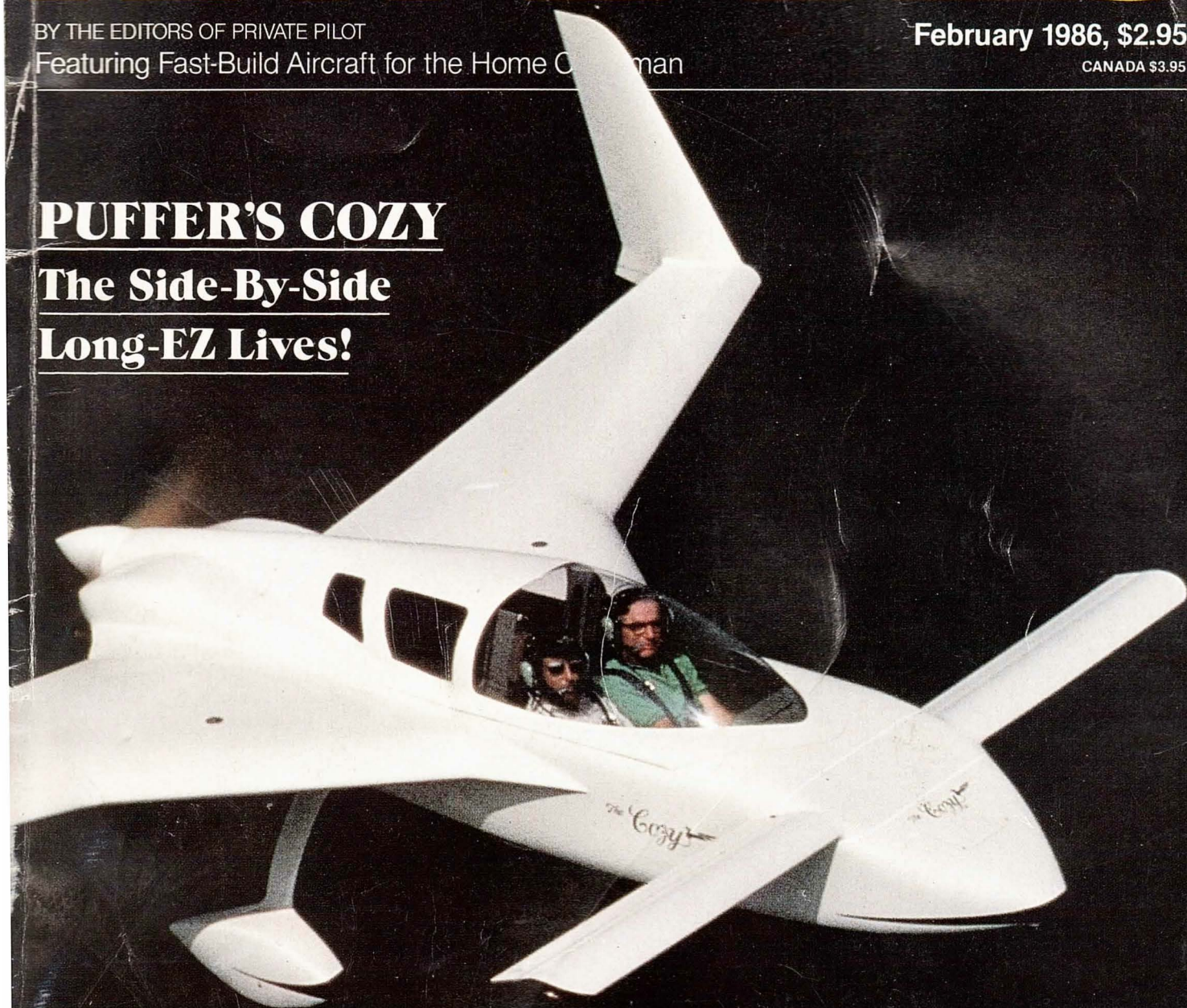
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**BUILDER TIP:  
PROJECT TABLE**



**Y**es, you can purchase Cozy plans and a periodic newsletter, obtain a complete bill of materials and a number of prefabricated parts, and have full-time builder support from Nat Puffer who originated the side-by-side modification of Burt Rutan's Long-EZ. Irrespective of what has happened at Rutan's operation in Mojave, California, Puffer is going full-steam ahead with his Cozy. Since Burt Rutan withdrew from further sale of plans, Puffer has continued with his Cozy project. He has a 500-member newsletter and has spent \$5500 in printing to bring his

total backlog of plans to 500. He continues to send royalty checks to Burt Rutan for the licensing agreement allowing him to use Long-EZ technology and says that these checks are being cashed.

We talked with Nat in Phoenix, Arizona, after his move from Minnesota. He advised us that he had recently visited Alpha Plastics and has approved them as a vendor for specified materials. Puffer reported an increase in his Cozy sales following Rutan's withdrawal from the business. He feels that some of this increase was due to the unavail-

ability of new Long-EZ plans, but that much of the increase was due to seeing the first plans-built Cozy fly at Oshkosh. The people who are inquiring about the side-by-side plans because the Long-EZ is no longer available are being screened very carefully by Puffer to make certain that they are not too heavy to operate the Cozy safely.

Nat and Shirley Puffer originally

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**You might not be able to get Long-EZ plans, but there's plans, parts and support for the Nat Puffer's side-by-side-seat Cozy.**

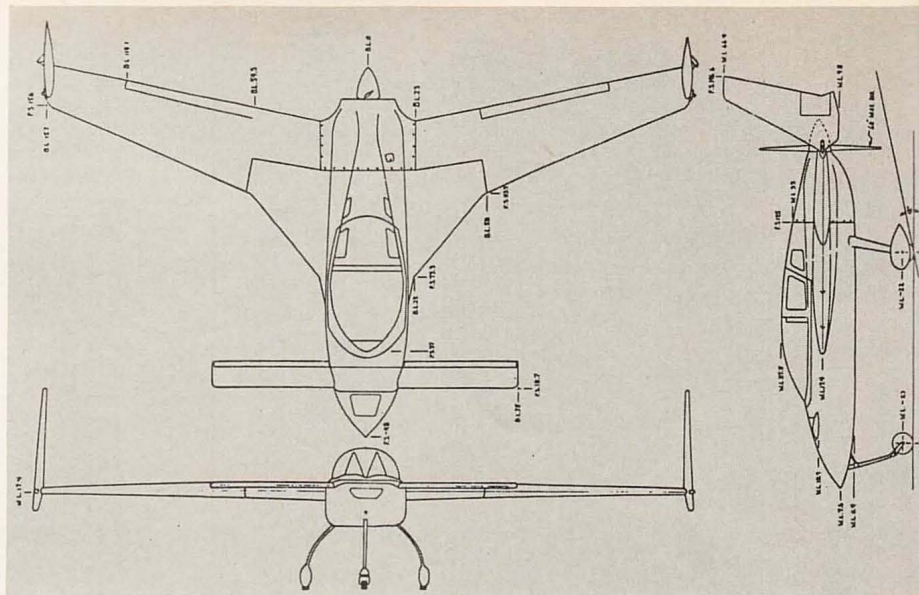




built the Cozy for their own use and it later evolved into a plans-built airplane. The Puffers together weigh only 280 pounds and the maximum design front seat combined load is 340 pounds. The designer advises that space limits the single individual to 6 feet tall and 185 pounds.

The Puffers' move to Mesa was planned long before Burt Rutan's announcement that he would no longer sell any plans. The Puffers live just one mile from Falcon Field where they have half a hangar and a request for a full hangar. "We really intend to spend full time pursuing our aviation interest," said Nat. "The thing which keeps most people from retiring early is that they don't have anything else to do. We are fortunate in having more work to do than we have time. We intend to spend full time on builder support. Of course, we plan to attend every airshow possible; in Minnesota we just were not able to consider all the shows down south."

Nat and Shirley developed their side-by-side Cozy with designer Rutan's reluctant approval. When they first broached the project to Rutan, the answer was identical to that of other designers when someone opts to change a final design: "No!" A year after the initial conversation, the Puffers were well on their way and on their own. They had decided that the minimum cockpit width would be à la Cessna 150 and the engine would be moved back slightly for center-of-gravity considerations. Other basic changes included position of the gear, canard span and control figuration. Eventually Burt relented, checked the modified drawings and, after seeing the airplane fly at Oshkosh in 1982, offered to license the Puffers to commercialize the Cozy using Long-EZ plans and technology. After considerable soul searching, the Puffers decided to go ahead with the project and began to tailor their lives accordingly. They then made a set of plans for a slightly larger cockpit to increase utility and had them carefully proofed and released for builders in late 1983. Puffer estimates that the Cozy will take perhaps 100 to 200 hours longer to build than the Long-EZ. Unlike the Long-EZ, the Cozy has a keel down the middle of the entire fuselage not only for added stiffening, but also to house the heater duct, wiring and control cables. All engine and flight controls except the side sticks are



**Plans for the Cozy modification of the Long-EZ are still available. An additional 100 to 200 hours of work goes into the wide-cockpit variant.**

mounted on a console above the keel and between the seats.

At least two of Puffer's builders nearing completion are using 150-hp engines rather than the original 115-hp Lycoming O-235. The Cozy developer's comment was: "Ethically, I cannot recommend something I haven't proven. The 150-hp engine results in a heavier

and hotter airplane. I know some of the things which are necessary to install a larger and heavier engine, but I'm not sure that I know all. We all know that homebuilders always figure they can go one or two steps beyond what the designer recommends. My responsibility is to recommend the safest systems and not to encourage people to use up the safety factor built into the design?"

And that's the way Nat Puffer sees it.

**FOR MORE INFORMATION, contact Co-Z Development Corp., 2046 N. 63rd Place, Mesa, AZ 85205; 602/981-6401.**

## Cozy

**Prices:** Plans, \$210; newsletter, \$5 a year; information kit, \$8.

### Specifications:

Wingspan ..... 26.1 ft.  
Wing area ..... 95.6 sq. ft.  
Overall length ..... 16.78 ft.  
Overall height ..... 7.91 ft.  
Wheel track ..... 5 ft.  
Wheelbase ..... 7.58 ft.  
Landing gear type ..... tricycle, retractable nosewheel  
Seats & configuration ..... 3, (2 side-by-side plus rear jumpseat)

### Engine:

Lycoming O-235, 118 hp.

### Weights and Loadings:

Gross weight ..... 1500 lb.  
Empty weight ..... 900 lb.  
Useful load ..... 600 lb.

### Calculated Data:

Wing loading ..... 15.69 lb./sq. ft.  
Power loading ..... 12.71 lb./hp  
Payload, full fuel & oil ..... 288 lb.

### Performance:

Maximum speed, sea level ..... 193 mph  
Cruise speed, 75% power ..... 187 mph (@ 8000 ft.)  
Cruise speed, 40% power ..... 143 mph (@ 12,000 ft.)  
Range, 75% power (@ 8000 ft.)....1200 s.m.  
Range, 40% power (@ 12,000 ft.)...1800 s.m.  
Rate of climb, sea level (gross) ..... 900 fpm  
Glide ratio ..... 17:1  
Service ceiling (gross) ..... 20,000 ft.  
Minimum speed ..... 60 mph  
Approach speed ..... 85 mph  
Takeoff ground roll ..... 1050 ft.  
Landing ground roll ..... 950 ft.

### Manufacturer:

Co-Z Development Corp.  
2046 N. 63rd Place  
Mesa, AZ 85205  
602/981-6401

**Source of information:** Co-Z Development Corp.



# A Comfortable Arrangement

Nat Puffer's Cozy Canard  
improves upon Rutan's Long-EZ.

BY DON DOWNIE

